

TAB 17

Explanation for Sudden Increase in Optiplex FIR Submissions - Q3FY06

Based on customer escalations and early FIR data it became evident in Jul'05 that the Nichicon UHN capacitor issue was expanding beyond the original affected timeframe of May'03-Mar'04 and that Nichicon's originally stated root cause of "intermittent process control" was no longer valid.

In the last week of Jul'05, Dell contracted a third party lab (Exponent) to perform rigorous failure analysis of the capacitors shipped after Nichicon's first corrective action. The ensuing investigation through August and September generated findings which dramatically changed the original assumptions used to project failure rates on the affected Optiplex motherboards.

	Assumptions for RC1 - Mar'05	Exponent/Dell Findings RC2/RC3 - Sep'05
Root Cause	Intermittent process control with bath parameters	Primary: Design issue with electrolyte chemical balance (lack of phosphate) Secondary: Process issues with bath control and surface scratching
Corrective Action	Manual bath control automated	Increased phosphate level of electrolyte, Aug'04
Capacitors Affected	Intermittent lots manufactured prior to Mar'04 (ww 0409)	ALL capacitors built through Jul'04 (ww 0430)
Capacitor Failure Rate	Projected from actual motherboard failure rates	Projections from actual failure rates combined with Arrhenius equation discovered which correlated capacitor temperature and failure rates based on a reduced eV curve
Customer Application	Primarily affects small form factor chassis in harsh environments (kiosk, POS)	All usage models affected because system idle can generate temps above Nichicon reduced eV values
Products Affected	SX270, GX270 KillerBee and Jazz small form factors	SX270, All GX270 form factors, GX280, WS470/670, PESC1420
Dell Affected Date Range	May'03 – Mar'04	May'03 – Nov'04: High Risk Dec'04 – July'05: Reduced Risk
Affected Ships (M)	1.8M	8.0M – High Risk 3.8M – Reduced Risk
Projected FoF MB's	312K	1.9M – YTD failures at 299K with most of population only at start of failure curve
Estimated CFA units	75K	670K

Increased failure rates across a broader customer set (not just POS/Kiosk/High usage) and multiple product lines resulted in incremental CFA and WUE expenses to manage customer escalations, particularly for those customers who had previous board/system replacements for RC1 which were then re-contaminated with RC2 capacitors.

In addition to a changing root cause, FIR projections were complicated by:

- Capacitor mix among three suppliers. Overall mix was evenly distributed among the three suppliers, however:
 - Capacitor mix varied by month
 - A system could have capacitors from multiple suppliers on same board (23 locations)
 - Complexity was resolved by projecting rates by month versus entire population
- Failure rates varied from region to region (customer usage, tech support execution); resolved by running model by region vs WWW
- Failure rate start, slope, and peak varied significantly between the 3 GX270 chassis; resolved by modeling rates by form factor
- CFA's could overstate failure rates; resolved by removing CFA coded dispatches in projection model

Nichicon Capacitor FIR Timeline

May'03 – Optiplex GX270 and SX270 products launched. Nichicon UHN series capacitors used in 17-23 locations on Dell designed motherboard. Capacitor mix distributed evenly among three suppliers.

Jan'04 – Bulged/vented Nichicon capacitors are identified on a small number of Optiplex motherboards at supplier repair center. Nichicon UHN capacitors placed on production hold until cause found.

Feb'04 – Nichicon submits root cause to be process control issue at their facilities (oxide bath parameters were manually adjusted). As a result not all production lots were affected since the process was in and out of control over time.

Mar'04 – Nichicon corrects process issue with automated bath control equipment. Dell audit at Nichicon validates corrective action completed and engineering hold on Nichicon UHN released. Capacitors with date code WW0409+ are built with new process.

May'04 – First customer escalation for bulged/vented capacitors (University of Texas Math Lab) on ultra-small form factor SX270. Investigation identifies capacitor failures to be specific to Nichicon (other two suppliers show no failures). Failure deemed to be induced by combination of Nichicon process issue and very aggressive user profile. Systems were used 24x7 performing advanced mathematical calculations with a hot AC adaptor brick placed below the air intake.

FIR Submission – No change: Early vintage SX270 curves show increase in MB FIR rates but on relatively small install base (139K ship w/ incremental 18K dispatches). Escalation deemed to be exacerbated by customer environment that was not typical for most customers. GX270 MB curves reviewed and found to be flat.

Oct'04 – First customer escalation for bulged/vented capacitors on GX270 KillerBee chassis (Walmart Pharmacy POS). Investigation validates Nichicon capacitors from the process control period (RC1) and results in 5K unit PFR in October.

FIR Submission – No change but formal investigation begins to gauge risk on GX270 population.

Dec'04 – Customer escalations increase for GX270 KillerBee form factor. Escalations continue to be focused around POS type usage pattern (high temp in a cabinet). Review of FIR curves of GX270 by form factor identifies increase similar to SX270 on KillerBee chassis built during Nichicon process control period.

FIR Submission – Increased Opti 0.7% points for FY04 on Oct'04 submission to account for increased SX270 and GX270 KillerBee form factors built between May'03 and Mar'04.

Mar'05 – Customer escalations expand into GX270 Jazz form factor and failures seen beyond POS applications on GX270 KillerBee for systems with RC1 capacitor failures. Peak on early vintage SX270 occurs at 450 days.

FIR Submission – Increased Opti 3.9 points for FY04 vintages to accommodate increased FoF and PFR for GX270 KillerBee and Jazz chassis. Projection based on curve shape of Scaron which accelerated 4 months prior to KillerBee and demonstrated a peak (see attachment).

Apr'05 – Nichicon calls meeting with Dell to explain additional changes made to capacitors effective Aug'04 (WW0430) as part of continuous improvement program to extend reliability (increased phosphate level). Review of returns to repair center finds UHN capacitor venting/bulging on post WW0409 capacitors.

May'05 – Investigation of failures for post-0409 capacitors (now called RC2) begins with Nichicon with focus on sizing of issue in relation to RC1. Expectation at this time was RC2 would be less than RC1 because RC2 benefited from the process improvements made in Feb'04. Nichicon UHN capacitors placed on hold 05/05/05 pending investigation and validation of improvement for post ww0430 (now called RC3).

Jun'05 – Customer escalations for GX280 KillerBee begin (Mayo Clinic, University of Michigan)

Jul'05 – FIR trends on early GX280 KillerBee vintages display similar slope as early GX270 with RC1 capacitors. Failure analysis internally and by Nichicon does not net root cause nor conclusive estimate of exposure. Dell contracts 3rd party engineering firm (Exponent) to perform failure analysis on post 0409 and 0430 capacitors.

Aug'05 – GX270 KillerBee actuals outpace Mar'05 projections, slope is greater than projected and peaks at 630 days (see attachment). Chemical analysis by Exponent reveals phosphate degradation in RC2 capacitors similar to those seen in RC1. Formal claim made to Nichicon to cover RC1 incremental expense.

FIR Submission – Increased FY04 Opti 3.4 points and FY05 1.0 point to cover GX270 increases on RC1 rates (FY05 affected with Feb/Mar shipments – RC1). Projections for RC2 and RC3 deferred pending FA conclusions from Exponent.

Sep'05 – Temperature dependency equation identified (Arrhenius Equation) enabling failure projections and system exposure based on UHN capacitor temperature in systems. Capacitor failure analysis combined with reliability curves from arrhenius equation results in two significant conclusions:

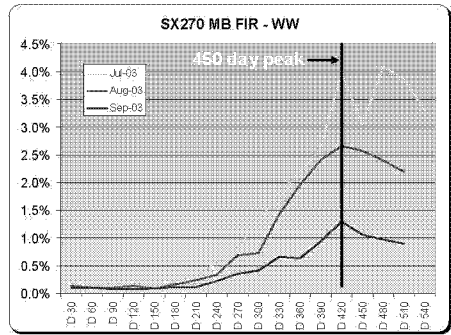
- 1) RC2 capacitors will have same failure curves as seen with RC1
- 2) GX270 Skydive at risk as well as entire GX280 product line built through Nov'04

RC3 date code capacitors demonstrate significant increases in phosphate levels with risk assessed at 0-20% of RC1 using Arrhenius curves, Nichicon, and Exponent data. Extended life testing established to validate exposure with completion date of Jan'05.

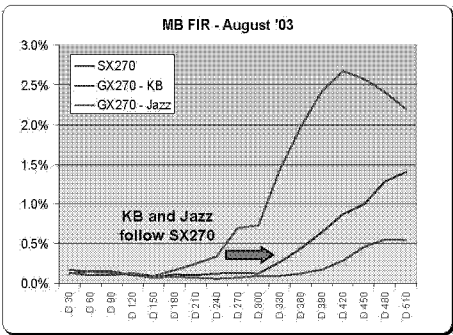
Oct'05 – CFA, WUE, and new board production demand finalized. Incremental risk identified on 3 Enterprise products affecting up to 93K systems WW and one Dimension product affecting up to 79K units WW.

FIR Submission – Increased FY04 Opti by 2.6 points, FY05 by 3.6 points, and FY06 by 1.7 points to cover RC2 and RC3 exposure. In addition, increases were made to Dimension FY05 (0.21 points), Workstations (2.63 pts) and Server (.05 pts) to reflect 4 platforms with exposure to RC2.

FoF Projection Modeling



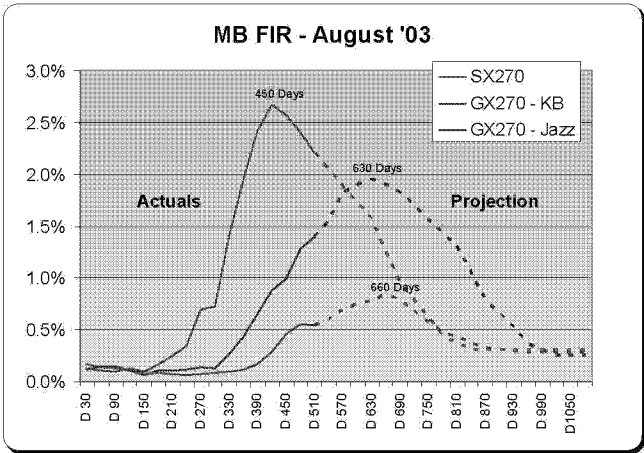
- SX270 utilized Nichicon caps between May'03 and Feb'04
- Increased failures seen first on SX270 due to higher temperature chassis
- Failure rate increases at 210 days and peaks at 450 days
- Month to month variation due to supplier mix and variation in Nichicon process



- KillerBee and Jazz chassis follow similar increase in failures 5 to 6 months later
- Delayed fail rate due to reduced thermals (chassis and application)
- KB and Jazz peak expected at 630 and 660 days respectively but at lower level than SX270
- Skydive chassis failures negligible

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FoF Projection Modeling



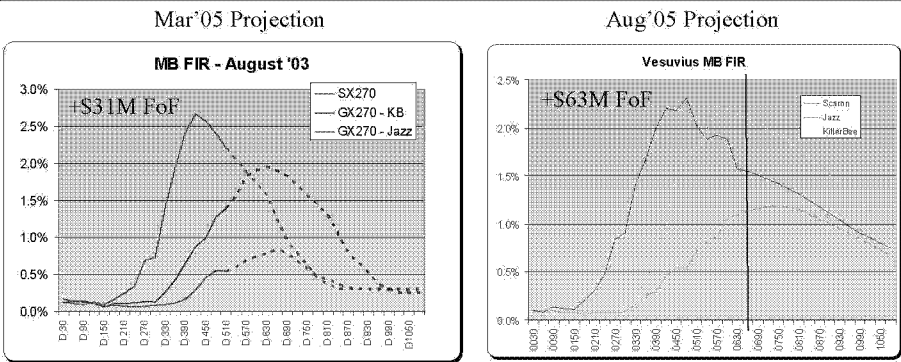
- SX270 used to project GX270 KB and Jazz FIR performance
- Variations by chassis, time period, and region required monthly modeling

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Aug'05 Projection Adjustment for GX270 and early indicator of GX280 risk

Be The REASON

GX270 Curves Higher



- Changes with more Actuals...
- Original Nichicon “cause” (variation of bath by week) proving to be incorrect with impact on original projections
 - Scaron downward slope did not accelerate as fast as projected
 - KillerBee monthly rate reached near Scaron peak
 - Concern with Jazz remains (will it rise to Scaron levels)
 - Failure rates with Opti MB's historical run at .10% per month are running at 2%+ per month (4% in some vintages)

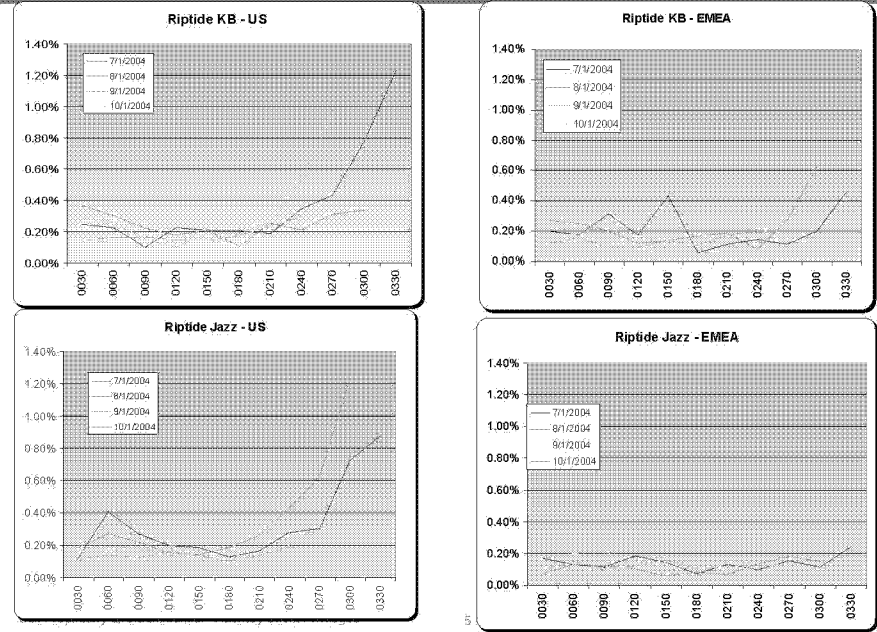
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Dell Customer Experience

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Riptide (GX280) Early Indications

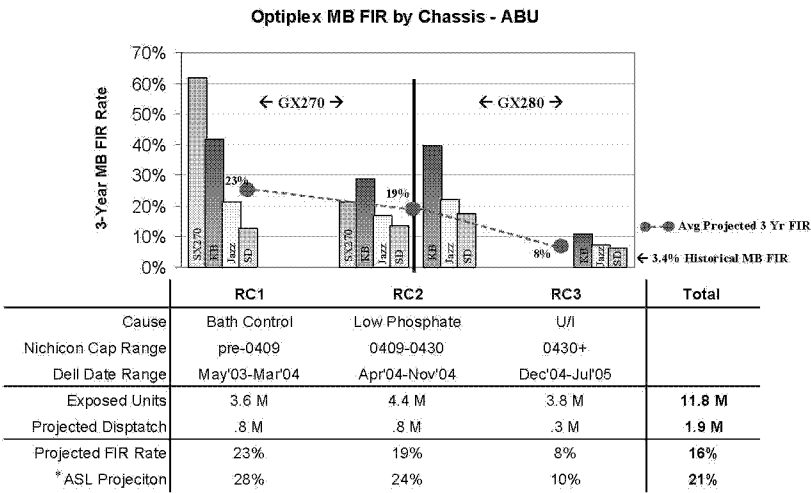


Sep'05 Capacitor Reliability Curve and FIR Impact

Be The REASON

ABU Opti Impact

Impact varies monthly by chassis type, capacitor mix, and capacitor variation (3 causes)



Vesuvius (GX270) RC1 and RC2

• **Arrhenius Equation:** Used to est. relationship for thermally activated processes.

$$\text{Acceleration} \sim \text{Exp} \left[\frac{E_a}{K_B} \left(\frac{1}{(T_{use} + 273K)} - \frac{1}{(T_{stress} + 273K)} \right) \right]$$
